REMARKS

Applicants gratefully acknowledge the telephonic interview conducted on July 7, 2005, with Examiners Miller and Walsh. Based on the Examiners' helpful suggestions, Applicants respectfully submit the following remarks and the accompanying 132 affidavit.

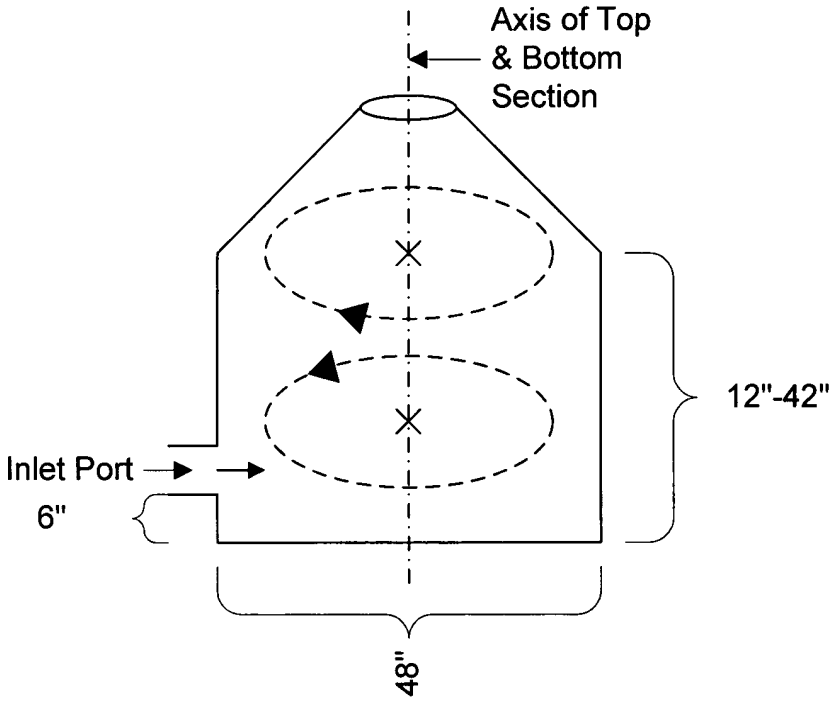
Claims 22-39, 41-50 and 53-71 are currently pending in the application. Claims 22, 23, 26, 29, 55, 56, 66, and 67 have been amended. Support for the amended claims can be found herein in the discussion of new matter. Claims 22, 38, 55, 62 and 68 are the only pending independent claims.

35 U.S.C. § 132 - New Matter Rejection

The specification is objected to under 35 U.S.C. § 132 because it allegedly introduces new matter into the disclosure. According to the Office Action, defining the term "sympathetic" to mean circulating in an opposite direction was not contained within the original disclosure. Applicants respectfully disagree.

Various sources support Applicants' definition of "sympathetic" above. In Webster's New Collegiate Dictionary, G. & C. Merriam Co., 1973, the first definition of sympathetic is "existing or operating through an affinity, interdependence, or mutual association." Interdependency is a property of sympathetic flow patterns, which as explained on pages 11-12, leads to flow patterns rotating in opposite directions. The interface between first and second flow patterns moves in the same direction thereby creating opposing vortexes. Applicants also direct the Examiner to Exhibit A, which is an article that discusses sympathetic flow patterns. The article, entitled "Analysis & Control of Unsteady Separated Flows," at page 4, column 1, refers to "sympathetic vortex formation." The 132 Affidavit states that these sympathetic vortexes, shown in Figs. 2, 3 and 6, are consistent with Applicants' definition.

As Applicants' affidavit makes clear, select embodiments of Applicants' invention establish **sympathetic flow patterns** comprised of one large recirculating vortex formed where the flow enters the chamber, and a second sympathetic vortex is formed above the first.



Applicant's Settling Chamber

As shown above, the **sympathetic flow patterns** are perpendicular to the axis of the settling chamber and top sections (substantially vertical axis) and the input port (substantially horizontal axis); the centers of rotation of the **sympathetic flow patterns** are shown as X in the above drawing. The **sympathetic flow patterns** are formed based on conservation of energy and momentum (fundamental precepts known to those skilled in the art) under select embodiments of Applicants' invention. There is a substantially horizontal plane of interdependent flow between the two flow patterns. Interdependent flow diverges, as flow approached the chamber wall, into two oppositely rotating flow patterns. Note, in the drawing above, the bottom vortex rotates counter-clockwise and the upper vortex rotates clockwise. The

sympathetic flow patterns are established to allow only particles, within a size range dictated by the hydrodynamic conditions, to be transferred from the bottom to the top flow pattern (this is why you can blow smoke rings). The applicants disclose the hydrodynamic conditions (chamber size, shape, and fluid volumetric flow rates) that enable separation of separation of fine particles "into two size ranges, the first size range being greater than about 10 microns and the second size range being no greater than 10 microns. Hence the sympathetic, or interdependent, flow patterns, circulating in an opposite direction, are an inherent feature of the application as originally filed.

Furthermore,"sympathetic" flow patterns were inherently disclosed by the written description of the application as originally filed. As the M.P.E.P. makes clear, an inherent feature or advantage that is not expressly disclosed in an originally filed application may be introduced by later amendment without introducing prohibited new matter:

> By disclosing in a patent application a device that inherently performs a function or has a property, operates according to a theory or has an advantage, a patent application necessarily discloses that function, theory or advantage, even though it says nothing explicit concerning it. The application may be amended to recite the function, theory or advantage without introducing prohibited new matter.

M.P.E.P. § 2163.07(a) (citations omitted.) The key to establishing inherency disclosure is demonstrating that the missing descriptive matter is necessarily present in the thing described in the application and that it would be so recognized by those of ordinary skill. *Id.*

Briefly, Applicants' specification states "the invention involves a settling chamber for separating nanoparticles with an aspect ratio of the height to the width of sufficient value to allow two circulation zones to be formed, one above the other." [p 3, line 17-19] Separation of fine particles "into two size ranges, the first size range being greater than about 10 microns and

the second size range being no greater than 10 microns, ... is comprised of the steps of: (a) introducing a gas-fluidized fine particle stream into a particle classifier vessel, the vessel having an inlet port and an outlet port located above the inlet port; (b) circulating the gas-fluidized fine particle stream inside the classifier vessel in such a manner as to define flow patterns within the vessel which provide for physico-chemical conditions whereby particles having a size greater than about 10 microns are separated from smaller particles; (c) substantially separating the particles in the gas stream that are larger than about 10 microns from the particles in the gas stream that are no greater than about 10 microns; and (d) passing the particles no greater than about 10 microns through the outlet port." [p 3, line 20 – p 4, line 6]

The Applicants clearly state two circulation zones are formed, one above the other, which affect the separation of the fine particles into two size ranges – referred to as the physio-chemical conditions. According to the Affidavit, certain configurations and dimensions of the chamber, as well as the positioning of the inlet port and the flow rate for introduction of the gas stream necessarily yield the physico-chemical conditions required for separation into "sympathetic" flow patterns. ,

According to the Affidavit, in one such embodiment, the base of the settling chamber may be about 48.0 inches, with the inlet port positioned about 6.0 inches above the base or floor of the vessel. The diameter of the inlet port may be about 12.0 inches. The height of the chamber may be between 12.0 inches and 42.0 inches. These dimensions provide a ratio of height to width of the settling chamber between about 1:1.14 and about 1:4 and a ratio of the position of the inlet port relative to the bottom section to the diameter of the inlet port is between about 1:2 and zero. With the introduction of a gas stream at a volumetric flow rate of between 100-200scfm, those of ordinary skill agree that "sympathetic" flow patterns (shown in the

drawing above) necessarily result in Applicants' chamber and establish the "physio-chemical" conditions required for separation.

To summarize, in select embodiments of Applicants' invention, the configuration and dimensions of the chamber, as well as the positioning of the inlet port and the flow rate for introduction of the gas stream necessarily yield "sympathetic" flow patterns. The term "sympathetic" is also used by those skilled in the art to describe flow patterns described in the Applicant's invention. These flow patterns are, therefore, an inherent feature or advantage of Applicants' invention, and should not be considered new matter.

Accordingly, Applicants respectfully request withdrawal of the new matter rejection.

35 USC §§ 102 and 103 Rejections

The Office Action rejects claims 22-39, 41-43, 46-50, 55-60,62-68, 70 and 71 under 35 USC §102(b) as being anticipated by U.S. Pat. No. 5,174,455 to Zelazny et al. (hereinafter "Zelazny"). The Office Action rejects claims 44, 45, 53, 54, 61 and 69 under 35 USC §103 as being unpatentable over Zelazny. During the interview, it was suggested that since the Zelazny chamber and Applicants' chamber share the same shape, Zelazny must inherently anticipate any and all claimed features or functions of the Applicants' invention. Examiners Miller and Walsh invited Applicant to provide an explanation and any evidence concerning the absence of inherent anticipation.

Applicant's chamber and Zelazny's chamber share the same shape – but that is where the similarity ends. The Zelazny chamber separates particles by reducing the flow velocity so coarse particles settle out by their own weight. *See* 132 Aff. A flow baffle made of 75 micron screen is placed in the flow stream to hinder the passage of coarse particles. *Id.* Zelazny also discloses inducing a cyclone effect on the particles (particle rotation around the vertical axis as shown in

Zelazny Figure 2), the cyclone effect resulting in the collection of coarse particles in the lower portion of the tank. *Id.* The Zelazny flow patterns, given in Figures 1 and 2, are from top to bottom with the possibility of a cyclone effect around the vertical axis – **sympathetic flow patterns** are never established. *Id.* Zelazny does not disclose the formation of a flow interface or the formation of a flow pattern related to the present invention, because they do not occur in the Zelazny devices. *Id.*

The Applicants explored Zelazny's technology as discussed the specification, given below.

> "Numerous patents have also addressed the state of the art of apparatuses that are used for the separation of particles of varying sizes. For example, one such patent, U.S. Patent No. 5,348,163 issued to Tunison et al. discloses a separation apparatus that utilizes an impingement plate. A drawback of this device is that tacky or wet particles rebound from the impingement plate and stick together, thus, forming larger particles, or 'snowballs' that can not be separated. Consequently, these snowballs cause a decline in the efficiency of the gas flow pattern within the chamber as well a decrease in the ability to separate particles.
>
> Methods which are typically used to conduct separation of particles in size ranges down to the micron-size include, but are not limited to, settling chambers utilizing various impingers, centrifugal separators, cyclone separators, and impingement separators. A drawback of each of the devices is that they do not efficiently separate fume from dust when the fume is tacky (i.e., bound together by electrostatic forces).
>
> Various solutions to the problem of producing high-quality nanopowders without the presence of microparticles are known, however. These include certain processes such as forming fume from the combustion of high-purity liquid precursors that are capable of producing microparticle-free nanopowders. A shortcoming of such processes, however, is that they also produce hard agglomerates of nanoparticles that are less desirable in many applications than condensed individual nanoparticles.
>
> A second solution is applicable in cases where the nanoparticles are not tacky. In such cases, turbine classifiers or high-efficiency cyclones may be expected to provide efficient particle size separation. A problem associated with this solution, however, is that it is extremely difficult to achieve electrostatic neutrality (i.e., non-tacky or non-condensing dry surfaces) on particles in the size range of interest without otherwise affecting the particles."

More specifically, Zelazny embodiment 1 contains a porous membrane. *See* 132 Aff. It is well-known to those skilled in the art that gas streams with commercially significant loadings of electrostatically "sticky" nanoparticles plug even extremely coarse porous membranes almost immediately. *Id.* After the membrane plugs, it effectively becomes a baffle, or impingment plate. *Id.* This configuration has been shown to be ineffective in the field of application of the present invention (see Fig. 1, Fig. 2 of the Applicant's application). *Id.* Zelazny embodiment 2 (Fig. 2) is a simple cyclone separator with the lower discharge removed. This device is different from the present invention by the discussion given above. Further, the primary mode discussed by Zelazny involves operation at 4500 ft/min resulting in a separation cut-off of 500 microns. In the field of application of the present invention, such low levels of separation performance are far below the acceptable performance of standard equipment and are have no commercial importance.

In addition, the burden of proving inherent anticipation rests with the Patent Office. . "In relying upon a theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. M.P.E.P. § 2112 at IV, *citing*, *Ex parte Levy* , 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original.) Importantly, inherency cannot be established by mere probabilities or possibilities. M.P.E.P. § 2112 at IV. Indeed, "[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.*, *citing*, *In re Robertson*, 49 U.S.P.Q.2d 1949, 1950-51 (Fed. Cir. 1999). In fact, there is no inherent anticipation of the Applicant's disclosure based on the size and shape similarity between the Applicant's Chamber and the Zelazny's Chamber.

A. **Claims 22-37 and 55-62**

With respect to amended independent claim 22, Applicants respectfully submit that Zelazny does not teach or suggest the limitation "wherein a ratio of height to width of the settling chamber is between about 1:1.14 and about 1:4 and a ratio of the distance between the inlet port and the bottom section to the diameter of the inlet port is between about 1:2 and zero." These dimensions impact the flow patterns established within the vessel after introduction of gas streams through the inlet port.

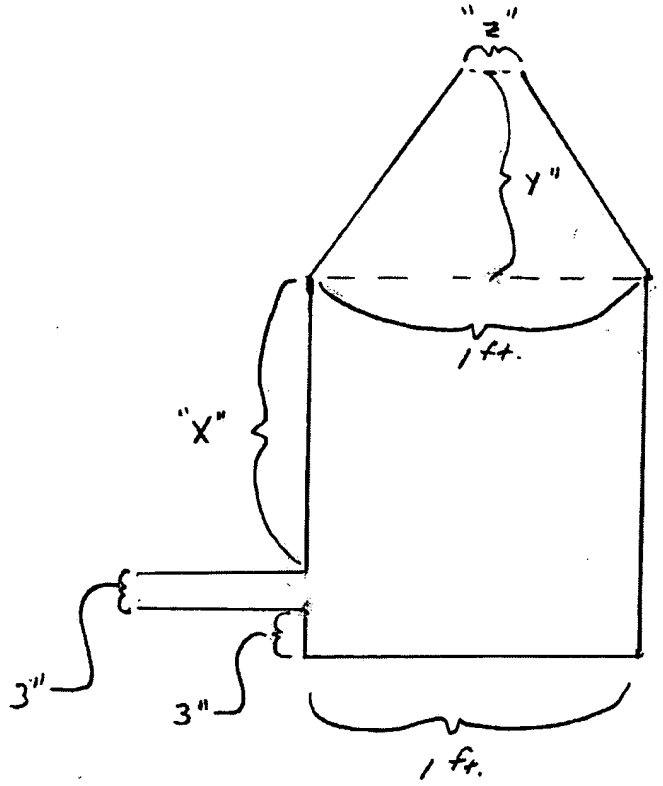
As concerns amended independent claim 55, Applicants respectfully submit that Zelazny does not teach or suggest a settling chamber comprising "an inlet port positioned about 6 inches above the bottom section, wherein a ratio of height to width of the settling chamber is between about 1:1.14 and about 1:4." Applicants also question whether the flow rates of the Zelazny gas stream can be converted into and meet a volumetric flow rate between about 100 and about 200scfm, as recited by claim 55.

Zelazny's written description is completely silent as to the dimensions of the device shown at Fig. 2 and therefore cannot expressly teach the ratios recited by amended independent claim 22. It was suggested during the interview that Zelazny does include dimensions, including a tank volume of 5 cubic feet and a width of 1 foot, at col. 2, ll67-68 and col. 3, ll 1-6, for example, and that this volume could be used to determine the remaining dimension of Fig. 2. Applicants disagree for two reasons. First, these dimensions do not relate to Fig. 2. And second, even if they did, they are insufficient to determine the remaining dimensions of Fig. 2 and/or the ratios recited by amended independent claim 22.

The Zelazny dimensions relate specifically to the tank of Fig. 1. Zelazny, at col. 2, lines 67-68 states tank **12** preferably has a volume approximately 5 cubic feet and a diameter of no

less than 1 foot." The Fig. 1 tank, designated by reference character **12**, is not the subject of the rejection applied by the Office Action against Applicants' invention. Instead, Fig. 2 forms the basis for the rejection. When referring to Fig. 2, Zelazny refers specifically to the tank with reference character **52**, not **12**. In sum, Zelazny discloses no dimensions for the tank of Fig. 2.

Even assuming the dimensions of the Zelazny tank of Fig. 1 were applied to the Zelazny tank of Fig. 2, it is still not possible to determine the relevant dimensions of Fig. 2. The absence of certain key dimensions precludes calculation of Applicants' claimed ratios:



Zelazny Fig. 2

Without the height of the cylinder "x" and the height of the cone "y" atop the cylinder, the volume of the tank (5 cubic feet) in connection with its width (no less than 1 foot) do not enable the ordinarily skilled artisan to determine the height of the tank or the ratios set forth by claim 22. The calculation of these dimensions would be mere guesswork, as various numbers

could be used for these dimensions and still satisfy the volumetric measurement of 5 cubic feet. Further, any effort to estimate these dimensions based on the size of the drawings is impermissible. *See Hockerson-Halberstadt, Inc. v. Avia Group Int'l.*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("it is well established that patent drawings do not define the precise proportions of the elements and may not be relied upon to show particular sizes if the specification is completely silent on the issue"). *See also* M.P.E.P. § 2125.

Accordingly, in the event the foregoing rejection is maintained, Applicants respectfully request that the Examiner provide all relevant calculations for determining the dimensions and ratios of the Zelazny vessel. In that way, Applicants can address any further rejections of independent claims 22 and 55 with specificity.

Given the foregoing, Applicants respectfully submit that the rejections of independent claims 22 and 55 in view of Zelazny should be withdrawn. Applicants further request allowance of dependent claims 23-37 and 56-62, as depending from an allowable base or intervening claim.

B. Claims 38, 39, 41-50, 53 and 54

Applicants also submit that Zelazny does not teach or suggest "a gas stream flow pattern comprising a first recirculating flow pattern in the bottom section and a second sympathetic recirculating flow pattern in the top section," recited by amended independent claim 38. As discussed during the interview and above in connection with the new matter rejection, the term "sympathetic" means circulating in an opposite direction. For example, the first recirculating flow pattern circulates in a clockwise direction while the second "sympathetic" recircultating flow pattern circulates in a counterclockwise direction.

Under Applicants' definition for the term "sympathetic," there is certainly no express teaching in Zelazny of the flow patterns recited by amended independent claim 38. The written

description does not describe sympathetic flow patterns and Fig 2 simply does not show them. In fact, Zelazny Fig. 2 reveals only a general top to bottom flow pattern within the tank.

It was nonetheless suggested during the interview that Zelazny inherently teaches sympathetic flow patterns based on the shape of the vessel of Fig. 2 and the arrows therein. The shape of the vessel alone is not sufficient to achieve sympathetic flow patterns. The relative dimensions of Applicants' chamber in connection with the positioning of the inlet port and the flow rate facilitate establishment of the sympathetic flow patterns. Since Zelazny does not teach or suggest these features (see above discussion for claim 22), introduction of gas streams into Zelazny's Fig. 2 tank does not "necessarily" cause sympathetic flow patterns – and in fact can not form sympathetic flow patterns under the conditions disclosed.

Further, the arrows at the bottom of the tank in Zelazny Fig. 2 do not indicate the flow pattern of the gas stream, as was stated during the interview. Rather, these arrows display the direction of the particles as they fall out of the circulation zone. The arrows are not only positioned adjacent to various particles, but the two arrows on the bottom right portion of the tank illustrate rotation in the opposite direction to the arrow on the bottom left. In other words, if the arrows represented flow patterns, they would be pointing in consistent directions to depict the overall path of the flow pattern. Indeed, the general flow pattern is from chamber bottom to top and arrows adjacent to particles indicate gravimetric settling.

It was also suggested that the distance of three inches, designated by reference character 66 in Zelazny Fig. 2 was sufficient for the gas stream to enter the Zelazny inlet port, contact the back wall of the tank and create a downward flow pattern in the bottom of the tank – the creation of a downward flow pattern would only entrain large particles, previously separated from the gas stream by gravitation, and prevent particle size separation. Applicants are aware of no such

teaching in Zelazny. Zelazny, at col. 3, ll 62-64, states that the "three inch clearance provides a location in the tank for the collection of particles.

Applicants respectfully call the Examiner's attention to 37 C.F.R. § 1.104(d)(2), which specifies that "when a rejection is based on facts within the personal knowledge of an employee of the Patent Office, the data shall be as specific as possible and the reference must be supported, when called for by the applicant, by the affidavit of such employee." If an inherency rejection is made based on the three inch clearance or otherwise, Applicants respectfully request that the Examiner provide either a reference or an affidavit detailing how and why the teachings of Zelazny inherently lead to the first and second sympathetic flow patterns claimed by Applicants in independent claim 38. Since Applicants provided an affidavit to support their inherency position, Applicants submit that it is only fair for the Examiner to do the same.

For the foregoing reasons, Applicants respectfully submit that independent claim 38 and all claims dependent therefrom are allowable. Favorable action is earnestly solicited.

C. Claims 62-67

Applicants respectfully submit that Zelazny also does not teach or suggest "establishing a gas stream flow pattern within the settling chamber, the flow pattern including an axis of rotation horizontal and substantially perpendicular to the inlet port," recited by independent claim 62. As discussed during the interview and shown in the above drawing, the flow pattern of claim 62 rotates around an axis that comes in and out of the page.

There is no express teaching in Zelazny of this type of flow pattern – in fact Zelazny teaches away from this type of flow pattern. Zelazny Fig. 2 teaches a flow pattern rotating around a vertical axis extending from the bottom of the Zelazny tank to the Zelazny outlet port. Although it was suggested that the arrows in Zelazny Fig. 2 indicate flow patterns of the gas

stream, as discussed above, the arrows are linked to the particles not the gas stream. Further, even if the arrows do correspond to the flow pattern, the arrows do not appear to depict a flow pattern that rotates about a horizontal axis substantially perpendicular to the inlet port.

There is also no evidence in the record that introduction of a gas stream under the teachings of Zelazny Fig. 2 "necessarily" yields a flow pattern including an axis of rotation horizontal and substantially perpendicular to the inlet port. In particular, there is no reference or affidavit evidence from the Examiner pursuant to 37 C.F.R. § 1.104(d)(2) concerning the presence of this type of flow pattern in Zelazny. Absent such proof of inherency, the rejection of independent claim 62 should fall. Likewise, the rejections of claims 63-67 should fall, as these claims depend on an allowable base or intervening claim.

D. Claims 68-71

Finally, for the reasons discussed above, independent claim 68 is allowable over the prior art of record because Zelazny does not teach or suggest "a first recirculating flow pattern in the bottom portion and a second sympathetic recirculating flow pattern in the top portion." Accordingly, Applicants respectfully submit that new independent claim 68 and all claims dependent therefrom (69-71) are allowable.

CONCLUSION

In view of the aforesaid, Applicants respectfully submit that all claims pending herein are in the condition for allowance. Favorable reconsideration is hereby requested. Further, the Examiner is requested to please contact the undersigned so that a further telephone interview may be scheduled.

Respectfully submitted,

July 29, 2005

Jonathan A. Harris
Attorney for Applicants
Reg. No. 44,744

WILDMAN, HARROLD, ALLEN & DIXON LLP
225 West Wacker Drive
Chicago, Illinois 60606-1229
Telephone: (312) 201-2189
Facsimile: (312) 201-2555
1551093-1

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